Robot-assisted Laparoscopic Adenomyomectomy

Taner Usta
Acibadem Mehmet Ali Aydinlar University

Salih Yılmaz (drslhylmz@yahoo.com)
Acibadem Altunizade Hospital

Aysel Ozkaynak
Acibadem Altunizade Hospital

Gizem Nil Ceylan
Istanbul Medeniyet University

Ahmet Kale
Health Sciences University, Kartal Lutfu Kirdar Training and Research Hospital

Engin Oral
Bezmialem Vakif University

Research Article

Keywords: Adenomyomectomy, adenomyosis, uterus-sparing surgery, robotic surgery, fertility

Posted Date: December 1st, 2022

DOI: https://doi.org/10.21203/rs.3.rs-2322563/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Adenomyosis is a benign uterine disorder where endometrial gland and stromal tissue are abnormally located within the myometrium. The common symptoms of adenomyosis are abnormal uterine bleeding (menorrhagia), dysmenorrhea, dyspareunia and infertility.

The gold-standard method for treating adenomyosis is hysterectomy. For patients who desire to preserve their uterus, an alternative therapy would be adenomyomectomy which is sparing uterus. Such a procedure may be performed with open surgery or minimally invasive surgery.

It is obvious that minimal invasive surgery would be better for the patient's health. However, there is inadequate evidence to decidedly say which invasive surgery which invasive surgery would be best for the patient. We suggest that one of the newest techniques, robotic surgery is to be preferred an alternative approach for gynecological operations as well as would be an option for uterine surgery. This technique would allow for 3-D visualization and multitjoint endowrist movement, which compared to laparoscopy, yields various advantages for surgeons.

We therefore recruit seven participants diagnosed with symptomatic adenomyosis who admitted to Endometriosis and Chronic Pelvic Pain Center of Acibadem Altunizade Hospital between March 2019 and January 2021 requested to preserve fertility. They all underwent robotic adenomyomectomy. The parameters evaluated herein will be, whether the pain and bleeding scores changed during the postoperative period, amount of blood loss during the operation and the associated decrease in Hg levels. Robotic adenomyomectomy is one of the uterus-sparing adenomyosis surgery methods and is safely applied in selected patients.

Introduction

Adenomyosis is a benign uterine disorder where endometrial gland and stromal tissue are abnormally located within the myometrium. It often causes abnormal uterine bleeding, dysmenorrhea, dyspareunia and infertility[1]. There are various theories on its pathogenesis and its effect on pain, bleeding and infertility are not fully understood yet. Nonetheless, increased uterine contractility, altered endometrial receptivity, induced neoangiogenesis, impaired uterotubal transport and some inflammatory factors have been implicated in adenomyosis[2]. The pharmacologic treatment of adenomyosis is similar to endometriosis. Currently, the gold-standard treatment method of adenomyosis is hysterectomy [3].

However, a definitive treatment method has not been acceptable in patients who want to preserve their uterus or desire to have children[4]. Currently, due to the increasing age of women who bear a child, uterus-sparing surgery has gaining importance in the treatment of adenomyosis compared to hysterectomy. Many methods have been described for the reduction of adenomyotic tissue in adenomyosis surgery. These techniques are classified into two categories based on whether the type of adenomyosis is focal or diffuse. Adenomyomectomy was first accomplished as a conservative surgery by Hyams in 1952[5], at that time surgical methods were consisting of wedge resection of focal adenomyosis and suturing. Specifically in focal adenomyosis surgery, in order to reduce the risk of recurrence and complications these techniques were further modified such as transverse H incision in 2004 by Fushita and colleagues and wedge uterine wall excision in 2011[6], [7]. For diffuse adenomyosis surgery, Nishida suggested asymmetrical dissection of the uterus in 2010[8]. In 2011, as an great importance in history of conservative adenomyosis surgery, Osada introduces the triple flap method[9].

In this procedure, via laparotomy adenomyotic tissue is completely resected, leaving a 1 cm margin of tissue adjacent to both endometrial and serosal layers. This is followed by uterine wall reconstruction[10].

Uterus-sparing surgery can be performed as laparotomic or minimally invasive surgery (laparoscopic or robot-assisted laparoscopic). However, the lack of a clear boundary between adenomyosis tissue and normal myometrial tissue makes surgery challenging. Another difficulty is reconstruction of the uterus by suturing. Robotic surgery allows 3D visualization and multitjoint endowrist movement that facilitates suturing, which has several advantages compared to laparoscopy. For this reason robot-
assisted laparoscopic surgery can be more suitable for adenomyosis surgery especially if patient have been diagnosed with a concomitant Deep infiltrative endometriosis (DIE).

Seven of the patients diagnosed with symptomatic adenomyosis admitted to Endometriosis and Chronic Pelvic Pain Center of Acibadem Altunizade Hospital between March 2019 and January 2021 requested to preserve fertility and were recruited for this study. They underwent robotic adenomyomectomy and analyzed retrospectively. The parameters evaluated herein will be, whether the pain and bleeding scores changed during the postoperative period and blood loss during the operation.

**Patients & Methods**

**Patients**

Six of the patients diagnosed as focal adenomyosis and one patient with diffuse adenomyosis admitted to the Endometriosis and Chronic Pelvic Pain Center of Acibadem Altunizade Hospital between March 2019 and January 2021 who requested to preserve fertility were enrolled in the study. Informed consent was obtained from all individual participants included in the study.

All patients with focal adenomyosis have already endometriosis and five of them were complicated with DIE and three of these patients also have ovarian endometriomas concomitantly. All patients were presented with dysmenorrhea and abnormal uterine bleeding. Five of six patients were presented with dyspareunia and three of them were presented with dyschezia. The demographic characteristics were in Table 1. The transvaginal ultrasonography (TvUSG) revealed DIE and focal adenomyosis on the posterior wall of the uterus at six patients and diffuse adenomyosis at one patient and no DIE findings at this patient. Adenomyotic tissue diameters were recorded with the anterior and posterior uterine wall diameters by TvUSG. All seven patients underwent robot-assisted laparoscopic surgery. The operation, incision and suturing times, incision type and blood loss were recorded. Numeric Rating Score (NRS) was recorded preoperatively and postoperatively in all patients.

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Acibadem University.

**Surgical Technique:**

All cases were positioned in the low lithotomy position with arms closed and shoulders supported. Before starting the operation, a uterine manipulator (Clearview, Clinical Innovations, Utah, USA) was placed in all cases, except for one patient who had no previous sexual experience. For this patient, the uterus was suspended to the anterior abdominal wall with a prolene suture. For the Da Vinci-Xi robotic system (Intuitive Surgical Inc, Sunnyvale, California, USA), four 8mm trocars and one 5mm assistant trocar were placed on the abdominal wall and the robot was docked. In cases with focal adenomyosis and endometriosis, endometriosis surgery was completed first. Then, a serosal incision was made on the adenomyosis tissue with monopolar scissors parallel to the long axis of the adenomyosis tissue. By controlling the bleeding with bipolar energy, the incision was deepened with monopolar scissors, and the adenomyotic tissue was divided in two parts by entering the endometrial cavity. Then, when the incision was vertical, the right and left (upper and lower if the incision is lateral) adenomyotic tissue was excised by maintaining sufficient subserosal and subendometrial myometrial tissue. The endometrial defect was then sutured with an absorbable suture. Then, one side serosal tissue was sutured to the contralateral subendometrial myometrium layer with a barbed suture (V-loc, Covidien, Minneapolis, USA) on both sides. It was sutured with the bi-flap technique without leaving any defect.

In the case with diffuse adenomyosis, an anteroposterior incision was made starting from the fundus of the uterus to the endometrial cavity and uterus was divided into two parts as right and left. Then the right and left adenomyotic tissues were excised. The endometrium was sutured with an absorbable suture and the uterus was sutured with barbed sutures using the bi-flap technique. Finally, the robot undocking was done.

**Results**
Between March 2019 and January 2021, seven patients with adenomyosis who desired to preserve their uterus were enrolled in this study.

Diffuse adenomyosis was found in 1 of these 7 patients, and focal adenomyosis was found in the other 6 patients. Concurrent endometriosis was present in 6 cases with focal adenomyosis (5 of all with DIE + endometrioma and one with only endometrioma). All cases with focal adenomyosis and Diffuse Infiltrative Endometriosis had dysmenorrhea, dyspareunia (not seen in virgin patient and abnormal uterine bleeding (menorrhagia) with chronic pelvic pain. The patient with endometrioma and focal adenomyosis was presented dysmenorrhea and menorrhagia. Abnormal uterine bleeding (menorrhagia) and dysmenorrhea were the main complaints in the case with diffuse adenomyosis. Endometriosis was not detected in this patient. In all patients with focal adenomyosis, lesions were found in posterior location of uterus. Patient's demographics are shown in table 1, all patients had dysmenorrhea and menorrhagia, dyspareunia were seen, five of them. Mean preoperative hgb was 12.3 ± 0.56.

Surgical outcomes of patients were shown in table 2. Mean operation time was 283.4min ± 28.6, mean incision time and mean suturing time were 52.2 ± 35.3 min and 57.7 ± 37.3 min respectively. Mean blood loss was 240mL. Mean hospital stay was 2.4 day.

No intraoperative and postoperative complications were seen. All patients were followed up as symptom-free in the postoperative period. Mean preoperative VAS pain score were 7.8 ± 1.345. Mean postoperative VAS pain score in 6th month were 0.57 ± 0.5, in 1st year 0.42 ± 0.5. Therefore significant decrease in VAS score were recorded.

Table:1 Patient Demographics
<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>BMI</th>
<th>Parity</th>
<th>Symptoms</th>
<th>Preop VAS Score</th>
<th>Endometriosis</th>
<th>Location of adenomyosis</th>
<th>Size of adenomyosis</th>
<th>Pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>36</td>
<td>21.3</td>
<td>0</td>
<td>Dysmenorrhea, Dyspareunia, Dyschezia, Menorrhagia</td>
<td>9</td>
<td>OMA, DIE</td>
<td>Posterior</td>
<td>41*23 cm</td>
<td>Adenomyosis</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>22.2</td>
<td>0</td>
<td>Dysmenorrhea, Dyspareunia, Dyschezia, Menorrhagia</td>
<td>8</td>
<td>OMA, DIE</td>
<td>Posterior</td>
<td>40*23 cm</td>
<td>Adenomyosis</td>
</tr>
<tr>
<td>3</td>
<td>38</td>
<td>23.1</td>
<td>0</td>
<td>Dysmenorrhea, Menorrhagia</td>
<td>8</td>
<td>OMA</td>
<td>Posterior</td>
<td>40*30 cm</td>
<td>Adenomyosis</td>
</tr>
<tr>
<td>4</td>
<td>31</td>
<td>22.8</td>
<td>1</td>
<td>Dysmenorrhea, Dyspareunia, Menorrhagia</td>
<td>6</td>
<td>DIE</td>
<td>Posterior</td>
<td>41*33 cm</td>
<td>Adenomyosis</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>22.3</td>
<td>0</td>
<td>Dysmenorrhea, Dyspareunia, Menorrhagia</td>
<td>7</td>
<td>OMA, DIE</td>
<td>Posterior</td>
<td>50*40 cm</td>
<td>Adenomyosis</td>
</tr>
<tr>
<td>6</td>
<td>37</td>
<td>21.4</td>
<td>1</td>
<td>Dysmenorrhea, Dyspareunia, Menorrhagia</td>
<td>7</td>
<td>DIE</td>
<td>Posterior</td>
<td>42*34 cm</td>
<td>Adenomyosis</td>
</tr>
<tr>
<td>7</td>
<td>41</td>
<td>22.8</td>
<td>0</td>
<td>Dysmenorrhea, Menorrhagia</td>
<td>10</td>
<td>No</td>
<td>Diffuse</td>
<td>Diffuse</td>
<td>Adenomyosis</td>
</tr>
</tbody>
</table>

OMA: Ovarian endometrioma, DIE: Deep infiltrating endometriosis

Table 2: Surgical Outcomes
<table>
<thead>
<tr>
<th>Case</th>
<th>Operation time (min)</th>
<th>Incision time (min)</th>
<th>Suturing time (min)</th>
<th>Incision type</th>
<th>Blood loss (ml)</th>
<th>Hospital stay (day)</th>
<th>Postop 6th mo VAS score</th>
<th>Postop 1st yr VAS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>246</td>
<td>21</td>
<td>39</td>
<td>Vertical</td>
<td>200</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>300</td>
<td>48</td>
<td>38</td>
<td>Vertical</td>
<td>220</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>337</td>
<td>87</td>
<td>92</td>
<td>Vertical</td>
<td>100</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>296</td>
<td>34</td>
<td>31</td>
<td>Vertical</td>
<td>250</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>254</td>
<td>33</td>
<td>28</td>
<td>Lateral</td>
<td>310</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>281</td>
<td>21</td>
<td>41</td>
<td>Lateral</td>
<td>250</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>270</td>
<td>122</td>
<td>135</td>
<td>Vertical</td>
<td>350</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mean</td>
<td>283.4 (246–300) min</td>
<td>52.2(21–122) min</td>
<td>57.7 (28–135) min</td>
<td>*</td>
<td>240 (200–350)</td>
<td>2.4 (2–3)</td>
<td>0.57 ± 0.5</td>
<td>0.42 ± 0.5</td>
</tr>
</tbody>
</table>

**Discussion**

Adenomyosis is a benign disorder of uterus and remarkable cause of dysmenorrhea, dyspareunia, menorrhagia and infertility of which mechanism has not yet been fully resolved [2].

Robotic surgery is used not only in hysterectomy in gynecology, but also in various fields such as surgeries for endometriosis patients with pelvic nerves involved and pelvic organ prolapse. [11], [12]

The gold standard of its treatment is hysterectomy. Nowadays, the mean age of women on giving birth to their first child is gradually rising. Therefore patients are more likely to prefer conservative surgery.

A consensus has not yet been reached regarding the conservative surgical approach to be used in the treatment of women with the desire for reserving fertility. These uterus-sparing methods are aimed at significant improvement of symptoms permanently. Many techniques have been developed for the incomplete and complete excision of the tissue in adenomyosis surgery. The triple flap method described by Osada in 2011 is of great importance in the history of conservative adenomyosis surgery, which first started with wedge resection described by Hyams in 1952 and was developed furthermore later on. In Osada procedure, the abnormal adenomyotic tissue is completely resected, leaving a 1 cm margin of tissue adjacent to both endometrial and serosal layers. This is followed by uterine wall reconstruction[10]. Osada performed this surgery by laparotomy and now conservative adenomyosis surgery can be planned as both laparotomy and minimally invasive approach.

Unfortunately, lack of a clear demarcation line between adenomyosis tissue and normal myometrial tissue makes this surgery arduous. Another challenging step is suturing the resulting defective tissue without leaving a gap which is an inevitable necessity for patients willing to conceive.

Minimally invasive approach can be considered as an alternative to laparotomy in terms of patient comfort [10].

Recent evidences suggest that minimally invasive techniques are linked to reduced bleeding, rapid recovery, less hospital stay and less complications when compared to laparotomy [13]. As a result of studies which comparing these techniques, claimed that laparoscopy may be a choice in focal lesions due to less pain, rapid recovery and decreased blood loss, but laparotomy may be preferred in diffuse adenomyosis due to reduced menorrhagia and recurrence [14], [15].

Meanwhile robotic surgery is becoming more and more widespread in the medical field, it makes technically challenging surgeries such as adenomyomectomy easier to perform[16].
Robotic surgery, which is a minimally invasive surgical method, seems to be more capable to fully remove adenomyotic tissue as it increases the wrist movements of the surgeon. Due to the linear movements of the laparoscopic instruments, it is difficult to suture the defective area. Thanks to the 3D image quality provided by the robotic system and the multi-joint ‘endowrist’ movement of the robotic arms in 7 different axes, suturation can be performed without leaving any defective areas behind.

In a study conducted by Chong et al in 2016 which compares the long term efficacy of robotic adenomyomectomy and laparoscopic adenomyomectomy showed no statistical difference in terms of surgical outcomes, except the prolonged duration of the operation time and suturing time which is regarded as a disadvantage of robotic surgery[17].

A case series were done in 2016 by Chung with 4 patients whom underwent robot-assisted laparoscopic adenomyomectomy. They found that robot assisted laparoscopy was superior compared to open myomectomy concerning blood loss, hospital stays, recovery times and adhesion rates.

In 2019, Shim et al compared surgical outcomes between robotic and laparoscopic adenomyomectomy. Laparoscopy demonstrated no statistical difference found weight of adenomyotic tissue removed and duration of hospital stay[18].

According to literature review, robotic adenomyomectomy studies performed so far are demonstrated in Table 3.
Table 3
Robotic adenomyomectomy surgeries in the literature

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Design</th>
<th>N</th>
<th>Type</th>
<th>Technique</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Barton et al[19]</td>
<td>Retrospective</td>
<td>2</td>
<td>Focal</td>
<td>Robot-assisted adenomyomectomy</td>
<td>Mean op time: 169.5 ± 47.3 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cohort</td>
<td></td>
<td></td>
<td></td>
<td>Mean Blood Loss: 25 mL</td>
</tr>
<tr>
<td>2015</td>
<td>Ma et al[20]</td>
<td>Retrospective</td>
<td>23</td>
<td>Focal</td>
<td>Robot-assisted Laparoscopy</td>
<td>As compared with L/T and Robotic surgery,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cohort</td>
<td></td>
<td></td>
<td></td>
<td>Robotic Surgery had</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Less estimated blood loss during operation(250 ± 249.6 mL vs 690.91 ± 776.47 mL)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shorter postoperative hospital days (2.57 vs 4.0 days).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The dysmenorrhea and pelvic pain of the patients nearly disappeared after surgery.</td>
</tr>
<tr>
<td>2016</td>
<td>Chong et al[21]</td>
<td>Prospective</td>
<td>33</td>
<td>Focal</td>
<td>Robot: 8</td>
<td>No difference in blood loss, Hg change, length of hospital stay, complication rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cohort</td>
<td></td>
<td></td>
<td>L/S: 25</td>
<td>Mean op time &amp; suturing time, longer in robotic group</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean op time: 159.25 ± 93.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean estimated blood loss: 117.5 ± 56.78 mL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Dysmenorrhea &amp; Pelvic Pain nearly disappeared 1–2 weeks after surgery</td>
</tr>
<tr>
<td>2019</td>
<td>Shim et al[23]</td>
<td>Retrospective</td>
<td>43</td>
<td>Focal</td>
<td>Robot-Assisted Laparoscopic Surgery</td>
<td>No difference in operative time, estimated blood loss, weight of resected nodule, length of hospital stay</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cohort</td>
<td></td>
<td></td>
<td></td>
<td>No serious perioperative complication observed in both group</td>
</tr>
<tr>
<td>2021</td>
<td>Hijazi et al[24]</td>
<td>Retrospective</td>
<td>34</td>
<td>Focal</td>
<td>Robot-assisted Laparoscopy</td>
<td>Mean uterine wall thickness 4.02 cm ± 1.11 dropping to 2.37 cm ± 0.84 postoperatively this led to a mean drop of 41% in the thickness of the affected Wall</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cohort</td>
<td></td>
<td></td>
<td></td>
<td>Total operative time, min, mean ± SD 279.82 ± 69.02 (141–436)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EBL (mL), 296.47 ± 160.77 (50–700)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean preoperative pain score 8.68 ± 1.12, while the postoperative mean was 0.06 ± 0.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hb drop, 2.31 ± 1.18 (4.7–&gt;0.6)</td>
</tr>
</tbody>
</table>

Although there are not enough meta-analysis studies, according to the meta-analysis results of Lavazzo and his colleagues provided a comprehensive meta-analysis of minimally invasive techniques in myoma surgery in 2016, they concluded that robotic surgery was better than laparoscopic surgery as shown in its less bleeding and blood transfusion need, lower complication rates, and shorter hospital stay in the postoperative period[25].

On the basis of these findings that robotic surgery may be superior to laparoscopy and will be preferred by surgeons and patients in conservative adenomyosis surgery.

Limitations of this study are the presence of concurrent endometriosis and the fact that endometriosis surgery would be performed at the same time in most of the cases may have an impact on the decision to perform the operation with robotic
approach and this can effect pain scores of the patients.

**Conclusion**

Overall these results indicate that for patients who desire to preserve their uterus, treatment is the complete removal of the adenomyotic tissue and reducing symptoms but surgical outcomes are not decisive.

For the patient's comfort, minimal invasive surgery may be preferred. These results highlights the hypothesis, which was that one of the minimally invasive techniques, robotic surgery, can be used in the treatment of adenomyosis, and this may be preferred by surgeons since robotic surgery allows for greater visualization and range of movement when compared to laparoscopy. The superiority of laparoscopy to robotic surgery in perioperative result has not yet been shown clearly in studies. For this reason there has not yet been any proven technique for uterus sparing surgery in the treatment of adenomyosis. Future investigations are necessary to validate the kinds of conclusions that can be drawn from this study. Since the complete removal of adenomyotic tissue is only possible with hysterectomy, we do not have enough information about how much adenomyotic tissue remains in the uterine-sparing surgery group and how much recurrence will occur in the future.

**Statements And Declarations**

The authors declare that no funds, grants, or other support were received during the preparation of this manuscript. The authors have no relevant financial or non-financial interests to disclose.

**Acknowledgments**

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Taner Usta], [Salih Yilmaz]. The first draft of the manuscript was written by [Gizem Nil Ceylan] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

**References**


Figures
Figure 1

*Vertical incision on the adenomyosis tissue*
Figure 2

Excision of the adenomyosis tissue
Figure 3

*Suturing of the residual tissue after excision of the adenomyosis tissue*